IT'S ABOUT TIME

A HISTORY OF ARCHAEOLOGICAL DATING IN NORTH AMERICA

Edited by

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CHAPTER 2

Stratigraphy and Archaeological Dating

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Stratigraphic dating has been part of archaeological method since Boucher de Perthes and others used it to associate artifacts with extinct Ice Age fauna. Relative-age determination based on the laws of superposition and context is used in all archaeological excavation and is used more frequently than almost every other dating technique. A site may contain hundreds of superimposed layers, plazas, foundation walls, or streets; in every case, stratigraphy is used to interpret the age relationships between artifacts and architecture.

The value of stratigraphic dating in archaeology becomes apparent in two principal ways—in our daily lives and in the classroom. Common sense tells us that when we rustle through our recycling pile to find the memo discarded a month ago. We use it to sort mail lying on our desks or clothing dropped on the floor. Superposition, as a function of gravity, is part of our everyday lives whether or not we are archaeologists.

The value of stratigraphy in archaeology is reinforced further in the classroom, where the principles of stratigraphy are introduced. As students, we learn that stratigraphy and its role in dating were not always part of archaeology. Excavations used to proceed without recording the superpositional arrangement of strata. Now, stratigraphy has gained such importance that it is always noted using terms such as relative dating, intrusion, stratification, and the law of superposition. We learn that archaeology was present at the birth of stratigraphy, when the diluvial-waters hypothesis was challenged and successions of rocks were correlated across great distances, but that stratigraphy was not necessarily considered when palaces, mounds, and villages were first being unearthed. We learn that it became important again when research questions demanded an increasingly finer scale of age determination and relative dating was the answer.

Indeed, in Archaeology 101 we learn that stratigraphy is more than a pile of clothing.

I would go so far as to say that in the classroom, we learn that for archaeologists, stratigraphy is stratigraphic dating. We use stratification to obtain two kinds of information: chronological and contextual. Age is determined by noting the relative position of superimposed artifacts: those on top are younger than those on the bottom. Context is the association of artifacts inferred from formation processes, including deposition, turbation, and human activities. Stratigraphy in archaeology is taught as the fundamental exercise in determining age and context. Very little other than superposition or its disruption is important to archaeological stratigraphy.

Historians of archaeology (Daniel 1950, 1975; Trigger 1989; Willey and Sabloff 1980, 1993) divide the discipline into periods before and after which archaeologists routinely practiced stratigraphic excavation. Stratigraphic dating using superposition can be accomplished in two ways, through stratigraphic excavation and through stratigraphic observation after excavation (Browman and Givens 1996). Stratigraphic excavation is a method of recording the arrangements of artifacts as excavation proceeds, separating artifacts of one layer from artifacts of stratigraphically different layers. Stratigraphic observation after excavation is a method of recording the superpositional relationship of artifacts in the sidewalls of trenches; artifacts are not separated during or (necessarily) after excavation. Although both methods employ stratigraphic dating, only the first is stratigraphic excavation.

Although not emphasized when stratigraphy is taught in the classroom or defined in textbooks, the shift from stratigraphic dating using general superposition in sidewalls to the implementation of stratigraphic excavation was an important event in the discipline of archaeology (Browman and Givens 1996). Heinrich Schliemann (1875) used superposition but did not excavate in stratigraphic layers at Troy. He simply turned to the sidewalls and identified the layer that contained pottery made by Greeks. On the other hand, Kathleen Kenyon kept strata separate during excavation at ancient Jericho but did not use the artifact groups she extracted to date the layers she excavated. Rather, she used references to the reigns of kings (Kenyon 1952). Archaeologists in North America, who were attempting to establish the antiquity of Clovis and Folsom points and cultures, used stratigraphic correlation with extinct Ice Age fauna. They followed the example of their geoscientist colleagues and extracted artifacts

and fossils together within each separate layer. Archaeologists who first attempted to establish the antiquity of the mounds in the Eastern Woodlands did not always keep layers separate (e.g., Holmes 1903; Moorehead 1928) but rather collected ceramics from the surface or from excavation units and mixed the artifacts from separate strata. This practice changed as soon as archaeologists discovered that pottery could be used to tell time through seriation (e.g., Gamio 1913; Nelson 1916; Vaillant 1927; see discussion in Woodbury 1960a, 1960b). Stratigraphic dating and stratigraphic excavation are both pivotal concepts in the history of archaeology, even though they are not synonymous.

Archaeologists typically do not learn the important history of stratigraphic dating during the course of their study. Textbooks emphasize that stratigraphy is important for relative dating but rarely offer information on the methods employed for stratigraphy or any other potential uses of stratigraphy. Students do not learn that stratigraphy means different things to different archaeologists and has been inconsistently applied throughout the history of archaeology. They learn only what is important to their discipline today; that stratigraphy is stratigraphic dating. Stratigraphic dating is the oldest of dating methods in the discipline and the most fundamental and pivotal to its historic development, yet the history of stratigraphic analysis is complex and varied, depending on the nature and age of the site being excavated.

I have been asked to explore the history of stratigraphic dating in the field of archaeology. As I have just pointed out, stratigraphy is crucial to sound archaeological interpretation; it has been since the beginning and still is. Rather than just exploring the historical importance of stratigraphic dating, I include a historical review of a slightly larger concept: stratigraphy as a whole. I examine the subtle connotations of the word "stratigraphy" within archaeology, exploring the differences between those using it in highly stratified sites with artifacts that span long periods of time and those using it in urban settings with historic artifacts that often change in rapid succession. Stratigraphic dating has its greatest potential in providing relative ages but is also crucial for correlations across time and space and for interpreting depositional history and site formation processes of any given context. Stratigraphic dating has figured prominently in the history of archaeological dating but remains an underutilized method for most archaeologists.

What Is Stratigraphy and Stratigraphic Dating?

Before the history of stratigraphic dating can be discussed, a definition of stratigraphy is warranted. Two definitions are offered: one from an archaeological perspective, the other from a slightly broader geoscientific perspective. These definitions point explicitly to the fundamental differences between geosciences and some realms of archaeology. These disciplines overlap but are not the same, and their use of stratigraphy reflects the differences.

Archaeological stratigraphy is defined as "the archaeological evaluation of the significance of stratification to determine the temporal sequence of data within stratified deposits by using both the law of superposition and context evaluation" (Sharer and Ashmore 1993:621). Another text offers that "stratigraphy is the study and interpretation of stratified deposits" (e.g., Joukowsky 1980:159).

Stratigraphy is defined in geoscientific contexts as "the science dealing with the description of all rock bodies forming the Earth's crust—sedimentary, igneous, and metamorphic—and their organization into distinctive, useful, mappable units based on their inherent properties or attributes. Stratigraphic procedures include the description, classification, naming, and correlation of these units for the purpose of establishing their relationship in space and their succession in time" (Salvador 1994:137).

The difference between these two definitions is minor but significant. The archaeological definition does not include the formal description, naming, and classification of strata. Rather, the archaeological definition indicates that the primary purpose of stratigraphy is dating and correlation, generally of artifacts and features within strata, and mentions the laws of superposition and context as guides in the analysis of stratigraphy. The geoscientific definition focuses on the description of rocks, their classification, and interpretation. The purpose of stratigraphy for geoscientists is the determination of relationships between strata in space and succession in time. For archaeologists the purpose is the establishment of temporal relationships exclusively.

The reason for this dichotomy is in part historical and in part scalar (Stein 1993). Archaeology is used differently by those who study very old periods (e.g., Paleolithic and Paleoindian) and younger periods (e.g., early agriculturalists, urban settings of complex societies, classical areas, and historic occupations). Archaeologists do not correlate rock units from one site to another and sometimes not from one pit to

another. Archaeologists do not describe deposits for the purpose of establishing relationships of the rocks (deposits) across space. Archaeologists are not often concerned with features as large as basins, oceans, volcanoes, or subduction zones (Stein and Linse 1993). Stratigraphy for archaeologists is not focused on spatial correlation. It is focused primarily on time. This focus, therefore, is reflected in the definition of stratigraphy in archaeology. It is essentially superposition and dating. Archaeologists have simply not emphasized description, naming, and classifying.

The History of Archaeological Stratigraphy and Dating

My approach to discussing the history of stratigraphic dating is to contrast those archaeologists who study people living in ancient (Pleistocene/Early Holocene) periods from those who study people living in more recent periods. In North America, there is a striking difference in the use of stratigraphy between these two groups. Stratigraphy is used very differently in the study of ancient hunters and gatherers from the way it is applied to the remains of more recent hunters and gatherers, or village and urban dwellers.

This review charts the history of stratigraphy in North America but must begin with a brief discussion of events in Europe that influenced North Americans substantially.

The Earliest Beginnings of Stratigraphy

Archaeology and the geosciences began together in the eighteenth century when various scholars used stratigraphy to question the biblically based chronology for the age of the Earth (Daniel 1976; Faul and Faul 1983; Grayson 1983; Trigger 1989). Associations among extinct fauna, primitive artifacts, and stratigraphically superimposed layers were sought, but these eighteenth-century scholars were generalists, not specialists. The disciplines that were much later to become separate and distinct entities shared, at this moment, the same history. Archaeology, stratigraphy, paleontology, and geology began simultaneously as earth science.

The European Influences: Steno, Smith, and Lyell

The beginnings of stratigraphy can be traced clearly to a concern with fossils. The first observers of rock sequences were actually

drawn to explaining the presence of marine shells in odd places such as the high peaks of the Alps, beneath the city of Rome, and on either side of the English Channel. The fossils demanded the naturalist's attention and explanation. The fossils in question were the remains of shells and large extinct animals, as well as artifacts, though these were not necessarily recognized as such at the time. These items were found in rocks, and when described could often be traced across great distances.

Nicholas Steno is usually credited with being the first stratigrapher (Faul and Faul 1983; Rudwick 1976). In the middle of the seventeenth century, Steno made a number of observations that, taken together, laid the foundation for stratigraphic reasoning. He first noted that the teeth he removed from a shark's carcass were similar to "tongue-stones" found in various rocks in Italy and subsequently demonstrated that "tongue-stones" were really fossil shark teeth and that they had not grown in situ within the rocks (Rudwick 1976:49–53). He also suggested that the shell-bearing strata beneath the site of ancient Rome must be older than the ancient city itself and therefore must be older than 3,000 years. From these observations, Steno reasoned that particles settle in a fluid in proportion to their relative weights or mass. If particles of various sizes were added to a fluid, they would be laid down in discrete, size-sorted layers and would produce horizontal layering or stratification. If an organism, in this case a shark or shellfish, died near the zone of accumulation, its body parts might be found within the sediment. He knew that these particles and shells must have been deposited particle by particle and layer by layer, one on top of another. Therefore, in any given sequence of multiple layers, a lower layer must be older than any overlying layers. This observation, which seems commonsensical, was revolutionary in 1669.

Steno's observations, now in the refined form of three principles, composed the underlying logic for almost all early interpretations of Earth's history:

> *Law of Superposition.* In any succession of strata not severely deformed, the oldest stratum lies at the bottom, with successively younger ones above.

> *Principle of Original Horizonality.* Because sedimentary particles settle from fluids under gravitational influence, stratification originally must be horizontal; steeply inclined strata, therefore, have suffered subsequent disturbance.

Principle of Original Lateral Continuity. Strata originally extended in all directions until they thinned to zero or terminated against the edges of their original area (or basin) of deposition. (Steno 1968:229–231)

These principles did not come to us directly from Steno, however. Only with hindsight can we see that their origins lie there. They developed through the work of at least four influential naturalists.

Abraham Gottlob Werner, a German professor at the Freiberg Mining Academy, was the first to establish the importance of Steno's observations (Conkin and Conkin 1984; Schneer 1969). Werner believed that all the materials visible in the Earth's crust precipitated, in the chemical sense, from a large ocean that originally covered the Earth. This ocean receded gradually to its present size. Precipitation occurred within this ocean, supposedly depositing minerals from above, below, or within, older rocks. The emphasis on the oceanic origin of all rocks and minerals caused this school to be labeled "Neptunists." Notice that Steno's principles concerning particle behavior were borrowed by Neptunists but that superposition was not.

James Hutton, a Scottish contemporary of Werner, offered a contrasting opinion for the origin of rocks (Dean 1992). Using laboratory experiments and field observations, Hutton proposed that igneous rocks were not precipitated in oceans but were instead cooled from molten rock. The emphasis on molten origins of rocks and minerals led to the label "Plutonism" for this school. Hutton also suggested that sedimentary processes observable today were responsible for the deposition of all sedimentary rocks. His method of using observation in the present to infer processes of the past led to his greatest contribution: uniformitarianism, or "the present is the key to the past." He combined uniformitarianism with superposition to argue against the Neptunists. Hutton built on Steno's principles and established the discipline of stratigraphy.

Werner and Hutton were theorists arguing about the origins of rocks, fossils, and stratification from lofty positions in the academy. Stratigraphy was not embraced by a wide audience, however, until a practical application was presented by a civil engineer, William "Strata" Smith. Because he was an engineer, Smith may not have been aware of the dispute between the Neptunists and Plutonists in 1796 (Phillips 1978), but he noticed certain repeating sequences of rocks and fossils in mines of southern England and used them to predict the depths of these layers. The Industrial Revolution (1789–1847) was driving this exploration, and whoever could expose and extract the coal

most efficiently made the most profit. Thus, the reading of stratigraphy was born out of necessity rather than theory. In 1815, Smith produced a map and description of strata across England that should be regarded as the world's first example of geologic mapping.

A similar map of strata and fossils was constructed for the Paris Basin, and by 1830, the strata of England, France, and Germany had been named and put into a sequence. In 1833, Charles Lyell published the last volume of his *Principles of Geology*, describing, among other things, the sequence of rocks and fossils throughout Europe. Lyell combined the theories of Hutton with the practical observations of Smith and created the discipline of geology (Lyell 1837).

At the same time that these naturalists and engineers were looking at fossils and layers of rocks, others were searching for the remains of animals living during the Ice Age in association with people making primitive artifacts. There are excellent summaries of these early discoveries (Daniel 1975; Grayson 1983; Trigger 1989), showing that early stratigraphers, like Smith and Lyell, noted the association of fossils, rocks, river gravels, and artifacts. They used superposition and uniformitarianism to establish the antiquity of people as well as to order, in relative time, all past life on Earth. They argued against biblical and catastrophic accounts of Earth's creation.

Prehistoric archaeology in Europe has been influenced strongly by the close connection to geological stratigraphy. The shared beginnings aligned Paleolithic archaeology with geology and paleontology, and there remains to this day a close association between archaeologists studying Paleolithic time periods and their geoscientific colleagues. The earliest of these prehistorians garnered great prestige because, like geology and paleontology, theirs was a science at "the forefront of creating a new vision of the history of the world" (Trigger 1989:101). Paleolithic archaeologists, who excavate caves and sites associated with glacial deposits, still enjoy this scientific status and close association with geosciences (e.g., Bordes 1961, 1968, 1972, 1978; Farrand 1975, 1993; Laville 1976; Laville and Rigaud 1973; Laville et al. 1980; Lumley 1975; Rigaud 1989, Rigaud et al. 1995; Villa 1983). They note changes in fauna, plants, artifacts, oxygen isotopes, and climate and relate them to the changes that geologists have inferred in other regions. They pay more attention to separating units based on physical descriptions of layers than those units based on animal remains, artifacts, and time.

Paleolithic archaeology set new standards for stratigraphic analysis

in the mid-nineteenth century, and those standards were maintained through the twentieth century. Many American archaeologists were trained in excavation by these Paleolithic archaeologists and transported their knowledge of stratigraphy back to America.

The European Influences: Schliemann, Kenyon, and Wheeler

The beginnings of stratigraphy in archaeology were also affected by scholars who came to the discipline from an entirely different methodological orientation. They explored the connections between archaeology and historical texts, languages, and classical civilizations (Daniel 1976; Trigger 1989). They collaborated with scholars in disciplines such as ancient history, linguistics, classics, and art history. Excavations of cities in Egypt, Greece, and the Near East led these scholars to exchange information with classicists and historians. Interest in Roman period sites led to texts, not geosciences. The sites in question had walls, foundations, streets, and inscriptions. The texts spoke greater volumes than the artifacts in strata, and the strata were effectively ignored.

Many of these early urban archaeologists drew plans of architecture and trench walls, but they did not pay any attention to these layers while excavating. In 1871, Schliemann identified, after excavation, seven superimposed layers at Troy. Woefully, Wheeler states:

> We may be grateful to Schliemann for plunging his spade into Troy, Tiryns, and Mycenae in the seventies of the last century, because he showed us what a splendid book had in fact been buried there; but he tore it to pieces in snatching it from the earth, and it took us upwards of three-quarters of a century to stick it more or less together again and to read it aright. (Wheeler 1954:43)

The point is that for European urban archaeologists, both before and during the first part of the twentieth century, stratigraphy and superposition were *not* the crucial observations on which dating rested. Historical texts, inscriptions, and known relationships to Egypt and other Near Eastern civilizations provided the foundation for site dating.

As late as 1952, Kenyon summarized the manner in which urban sites occupied within the last 3,000 years had been dated:

> Basically, all such datings go back to the dating systems established by the great empires of the Near East. As the city states and then kingdoms increased in complexity of organization the need for some chronological basis for records became apparent, and also some method for calculating the seasons.... Therefore a system based on observation of the stars was worked out, and on this system was based the records of the reigns of the kings. Modern scholars have been able to correlate these records with our present calendar within a small margin of error. (Kenyon 1952:23)

Kenyon recognized that dating urban sites from this period is accomplished by using the Egyptian King's List. No mention is made of stratigraphy. She was, nevertheless, aware of the contrasting manner of dating used by other archaeologists. She points out that

> For the earlier periods, including the whole of the Paleolithic and Mesolithic periods, such [text-based] methods clearly cannot be employed since at this time there was no contemporary historical record with which stages of development could be correlated. For these periods largely geological evidence has to be employed. Geologists and geochronologists have been able to provide a broad chronological framework for the advance and retreat of the ice-cap during the glacial period. (Kenyon 1952:24)

Browman and Givens (1996:83) suggest that Schliemann, Kenyon, and Wheeler did not excavate the layers separately, however, or collect artifacts within strata separately. Stratigraphic excavation was therefore not yet practiced, even if stratification was described. Superposition was not needed to date the artifacts, and artifacts were the primary target of these turn-of-the-century archaeological interests.

From the influence of Kenyon and Wheeler came a book about stratigraphy, written for these urban archaeologists. Edward Pyddoke (1961) wrote *Stratification for the Archaeologist* because "there are books and reports from which a beginner in archaeology can learn something concerning the identification of antiquities... but there appears to be no publication which will introduce the archaeologist to the great variety of deposits in which antiquities are discovered or to the processes which lead to their becoming buried and preserved" (Pyddoke 1961:13). The book was for those "archaeologists who have no formal training in the natural sciences or whose work keeps them much in museums and libraries" (Pyddoke 1961:13). He summarized the stratigraphic analysis practiced by these early urban archaeologists as follows: "Whilst most archaeologists today are aware that the strata or layers to be seen in the sides of almost any trench cut vertically into the superficial coverings of the earth are no longer generally regarded

as simply part of the God-given structure of a created world, there do remain those who are content merely to draw and number these strata without always discovering and understanding the method of their depositing" (Pyddoke 1961:13). Pyddoke was a natural scientist attempting to train archaeologists, from art, classics, history, and ancient studies.

Even from this brief treatment, it is clear that events in Europe significantly influenced archaeologists working in North America.

North America

In the Americas a similar dichotomy developed between those archaeologists who focused on the oldest periods of prehistory and those who focused on recent, more complex, and usually sedentary, cultures. As might be expected, these groups came to stratigraphy at different times and from different roots. Those who studied the oldest periods of prehistory, in this case the Paleoindian period, maintained close ties with the geosciences (Meltzer 1983). Those who studied more recent periods, especially those in which ceramics were manufactured and used, developed their own techniques for using the contents of strata to tell time (Browman and Givens 1996). These latter used pottery, architecture, art, and ethnography to date sites and correlate them across space. In point of fact, these archaeologists can be divided into two groups: those that used stratigraphic dating in conjunction with seriation and those that use it in conjunction with architectural reconstruction or, more specifically, historical archaeology.

Stratigraphy in Paleoindian Archaeology

Archaeological research seeking the first inhabitants of North and South America went through two phases, only one of which utilized stratigraphic dating. The first archaeologists to construct North American artifact sequences believed that cruder object morphology indicated greater antiquity (Meltzer 1983). The shape of the object was compared to forms found in the Lower Paleolithic of Europe: If the shape was crude, the object was believed to be old. If morphology was sophisticated, then the object was thought to be much younger. This comparative use of culture sequences from Europe did not require the use of stratigraphy or stratigraphic dating; it was, simply, comparative morphology.

The comparative, nonstratigraphic approach was replaced at the turn of the century by the use of stratigraphic criteria to evaluate the

ages of sites. In 1912, Aleš Hrdlička (1912; summarized by Meltzer 1983:29) described the requirements necessary to demonstrate that human bones were geologically ancient. "One had to prove 1) that the specimens were found in geologically ancient deposits, 2) that the age of the deposits was confirmed by paleontological remains, 3) that the bones presented evidence of organic as well as inorganic alterations, 4) that the bones showed morphological characteristics referable to an earlier type, and 5) that the human remains were not introduced in later times." These steps required the use of stratigraphy, and without its use, a site was not considered ancient. After 1912, early sites in America were evaluated using geological stratigraphy: association, context, and fossils.

In response to the recommendations of Hrdlička, most North American archaeologists who sought the continent's earliest inhabitants worked closely with geologists who were reconstructing the Ice Age environment or were themselves geologists. For example, Edgar B. Howard (1935) conducted early excavations at Blackwater Draw Locality 1 and the Finley site (Howard 1943), E. H. Sellards excavated numerous sites in Texas and New Mexico (Sellards 1952), Frank Roberts excavated at Lindenmeier (Roberts 1935a). All of these archaeologists carefully described the strata containing bones and artifacts because their research goals were, often explicitly, to establish the stratigraphic position of the artifacts and their association with extinct fauna. Therefore, the reports written by these individuals included descriptions of site stratigraphy and stratigraphic sequences; most of them correlated these strata across a wide region and discussed the significance of soils as indications of periods of landscape stability. All of them used stratigraphic dating and context to arrange artifacts in a temporal sequence.

Kirk Bryan, a Quaternary geologist at Harvard University, strongly influenced archaeologists who studied the Paleoindians by training and encouraging his geology students to look for fossils and artifacts associated with glacial features and to cooperate with their archaeological colleagues (e.g., Bryan 1937). The association of artifacts and extinct fauna thus was as important to Bryan as it was to the archaeologists (Haynes 1990). At the Lindenmeier site, for example, the research into its geologic history began in 1935, at the same time as the archaeological excavations. The geologic history was summarized by Bryan and Ray (1940), and most of the work was completed by Louis Ray as part of his dissertation. The archaeologist investigating

Lindenmeier, Frank H. H. Roberts, thus employed geologically oriented field methods as part of his archaeological research (Roberts 1935a). Bryan encouraged this interaction and instilled in his students a sense of interdisciplinary cooperation that affected the archaeological discipline for decades (see summaries of regional histories in Mandel 1999).

Every Paleoindian or pre-projectile-point Archaic site is scrutinized today in much the same way that Hrdlička recommended: Archaeologists must consider whether the site is found in geologically ancient deposits, with appropriate Pleistocene fossils, with no evidence of intrusions or reversals. Archaeologists searching since the turn of the century for evidence of the earliest people in the Americas used, and are using, stratigraphic excavation and stratigraphic dating designed by the best of the Quaternary geologists (e.g., Kirk Bryan). Their methods were precise, detailed, and well documented.

Some archaeologists today are still heavily invested in establishing the antiquity of people in the Americas (e.g., Dillehay 1989, 1997), and I would point out that these archaeologists remain closely affiliated with geoscientists and geoarchaeologists (e.g., Holliday 1997; Johnson 1995) or are geoscientists themselves (like C. Vance Haynes, Reid Ferring, Rolfe Mandel, and Vance Holliday) and continue to use stratigraphic dating as well as stratigraphic excavation. Even though new highly refined absolute-dating techniques have become standard (see Taylor and Aitken 1997), they continue to rely on the basics of stratigraphic dating.

During this entire period, the techniques for field description and recording of artifact provenience and context have changed little, and therefore require little historical analysis. Equipment used today is different, and samples are collected for a host of analyses that were never dreamed of in 1935. Stratigraphy and stratigraphic dating used by archaeologists studying Paleoindians in the first half of this century, however, are very similar to those used by Paleoindian specialists today, as well as geoscientists. A historical review of stratigraphic dating, therefore, must acknowledge these early advances and the influence of these archaeologists on the discipline as a whole, but there is little reason to chart more recent activities as closely because, aside from the addition of many absolute dating techniques and the refinement of regional sequences and correlations, the use of stratigraphic dating has remained very consistent among those archaeologists studying Paleoindian occupations.

Stratigraphy for North American Archaeologists Investigating Complex Societies

Archaeologists who investigate complex societies in North America followed a pathway different from those archaeologists who investigated Paleoindians. They did not collaborate with geoscientists or follow the recommendations of Hrdlička after 1912. These archaeologists were attempting to find out whether the living Native Americans were descendants of the Moundbuilders (Trigger 1989; Willey and Sabloff 1993), and stratigraphic excavation was less effective in answering that question. More important in this regard was demonstrating continuity from historical and ethnographic descriptions of living Native Americans to the pre-Contact artifacts found in the ground. Part of the question concerning descendancy was the issue of antiquity of the mounds and other foundations of village settings present on the landscape. These archaeologists did not have texts or king lists to date their strata, nor did they have easily dated historic objects, such as coins, at their disposal.

These archaeologists were scrambling to figure out the antiquity of North America's recent inhabitants, but they could not use the methods of the archaeologists working on Paleoindians, who had extinct fauna and thick strata that could be correlated across large distances. Village sites in the eastern United States were shallow and spread over plowed surfaces; in the west they consisted of architectural structures on the surface with clearly visible pottery scattered over features such as floors and plazas. The early efforts by these urban archaeologists thus did not include the use of stratigraphic methods. Instead, archaeologists such as Cyrus Thomas, William Henry Holmes, and Max Uhle tried to determine the distribution and relative age of various urban cultures via analysis of architecture and pottery styles. They may have recognized that stratified deposits could provide dates based on superposition, but they chose instead to focus on pottery styles and regional distributions of those styles to arrange pottery into rough chronological order. Thus, stratigraphy was not recorded in their excavation notes. Their emphasis was focused toward the kinds of pottery found in each site and in each region.

Seriation

In the Americas, archaeologists interested in complex societies embraced stratigraphy only when the new technique of seriation established beyond a doubt that piles of accumulated pottery could be used

to determine the antiquity and age of sites (Browman and Givens 1996; see Blinman this volume). Archaeologists credited with being the first to use stratification and the underlying assumption of the law of superposition are Manual Gamio, Nels Nelson, and A. V. Kidder (Browman and Givens 1996; Trigger 1989; Willey and Sabloff 1993). These archaeologists did not always save all the sherds from every layer, nor did they use only natural levels to group their sherds. They did, however, demonstrate the potential of stratigraphic excavation, and others quickly followed. Seriation ushered the "stratigraphic revolution" (see discussion in Willey and Sabloff 1993:97–108) into North American archaeology (cf. Lyman et al. 1997; Lyman et al. 1998).

North American Archaeological Stratigraphic Terminology

American archaeologists in the 1920s and 1930s who were not involved in Ice Age reconstructions thought they invented archaeological correlation because they came from an anthropological background, had not used stratigraphy in a geoscientific sense, and therefore did not really conceptualize the method they invented as stratigraphy. These new stratigraphers established chronologies using the vertically differentiated frequencies of projectile points or ceramic types. Unlike the archaeologists investigating Paleoindian occupations, these archaeologists did not need a rigorous geoscientific analysis of the strata, just an occasional notation of what was above and what was below the strata in question. For the first time, archaeologists were able to estimate the age of landforms using artifacts.

In the period from 1930 until the development of radiocarbon dating, a reversal in professional consulting therefore occurred—geologists began going to archaeologists for assistance in dating recent landforms (Stein 1987, 1993). Urban archaeologists, armed with seriation, moved into a respected position as purveyors of a separate and distinct discipline, all predicated on the fundamental tenet of Steno and Smith—superposition.

Along with this new technique came new terminology and methods (Heizer 1949). For example, Phillips et al. (1951) describe stratigraphy and their methods of excavation in the Lower Mississippi Valley.

> To many archaeologists, stratigraphy necessarily involves a situation in which materials can be segregated on the basis of distinct and separable soil zones. Such is frequently not the case. It frequently happens, as we shall show, that a homogeneous deposit, without observable soil stratification, may be made to yield a stratigraphic record of the utmost value. Obviously, such an unstratified deposit will have to be excavated by arbitrary levels, to which method the term "metrical stratigraphy" has sometimes been applied in derogation, as opposed to "natural stratigraphy" obtained by peeling stratified layers.... Village site deposits in the [Lower Mississippi] Alluvial Valley rarely exceed 1 to 2 meters in total depth. Ten centimeters was therefore chosen as a unit of depth, convenient for seriating, without presenting serious difficulties in excavating. The first cut... was dug 3 meters square, but on finding that a sufficient yield of sherds could have been obtained from a smaller area, subsequent cuts were made only 2 meters square. Ideally, cuts should be dimensioned to get an adequate sherd sample per level from the smallest possible space, but we could never agree as to just what constituted an adequate sample, and therefore adhered to the convenient 2 meter square throughout. (Phillips et al. 1951:240–241)

Phillips et al. (1951) separated one natural level (i.e., lithostratigraphic unit; see Stein 1987, 1990) into many parts so as to capture the artifacts in small, more highly resolved, levels. The levels were 10 cm thick, a thickness thought to represent the shortest period of time that is meaningful for artifact accumulation and therefore artifact grouping. In these sites, no physical stratification of the sediment was observed, so the archaeologists could not differentiate levels on the basis of physical characteristics. Yet they did not want to miss changes that may have occurred in the artifacts deposited in that one layer. They knew that using arbitrary levels to group artifacts is not traditionally called stratigraphy, because the arbitrary levels do not represent stratification of sedimentological attributes. The archaeologists did recognize, however, that their arbitrary levels are a kind of chronological interpretation based on superposition. What is unusual about their separation was that they believed stratigraphy using arbitrary levels was very different from stratigraphy using natural levels.

Phillips et al. (1951) thought that they invented a new kind of stratigraphy, one based on arbitrary levels. I suggest that the sherds deposited in the sediments are just as stratified as a sequence of physically different layers. The sherds do not defy the law of superposition; they were laid down one atop another, just like sand grains or gravels. The sherds are found in superpositional order. Their analysis is therefore not different from stratigraphy. The process is the same as studying a sequence of different lithological units. John Phillips, Jack Ford, and J. B. Griffin, as well as Manual Gamio, Nels C. Nelson, and Alfred

Vincent Kidder unknowingly reinvented an archaeological stratigraphy using culturally manufactured objects. Their stratigraphic method is analogous to using fossils, magnetic polarity, or chronometric analysis.

The Lower Mississippi Valley archaeological project (Phillips et al. 1951) greatly influenced American archaeology. From the efforts of these archaeologists came many of the basic excavation strategies, terminology, and methodology that have come to be an integral part of American archaeology (Willey and Phillips 1958). The terms "component," "phase," "horizon," and "tradition" were developed to facilitate correlation. What was actually invented, however, was a procedure analogous to the procedures for correlation used in Paleoindian archaeology and geological stratigraphy. Though the archaeologists were not using lithostratigraphy in a strict sense, they relied on stratigraphic relations to guide their analyses.

Phillips et al. (1951) understood these differences and similarities when they first proposed their stratigraphic method:

> The distinction, however, between "stratification," the description of the actual ground situation, and "stratigraphy," [we shall refer to] as applied to the chronological interpretation of the ground situation, whether by "natural" or "metrical" methods, is a useful one and will be maintained here. Under the heading "stratification," we shall refer to soil zones as revealed by trench profiles; under "stratigraphy," the analysis of the excavated material and interpretation of the results. The one is what you find, the other is what you do with it. The separation will serve to bring out the fact that it is possible to have stratigraphy without stratification and vice versa. In line with this distinction, the terms "stratum," "zone," "deposit," etc., will be hereinafter used to refer to the ground stratification, the term "level" being reserved for the arbitrarily excavated unit of "metrical" stratigraphy. (Phillips et al. 1951:241)

Phillips, Ford, and Griffin thus suggested their own stratigraphic code in 1951. "Stratum," "zone," and "deposit" are lithostratigraphic terms based on physical attributes. "Levels" are ethnostratigraphic terms based on artifacts (Stein 1987, 1990, 1992). I wonder what impact a conversation with a geoscientific stratigrapher would have had on their code. Would they have seen the similarity and behaved differently as a result? Perhaps they did talk to stratigraphers, but later archaeologists missed the important difference between stratification and stratigraphic interpretations based on artifacts.

Although Phillips et al. (1951) understood that the observation and description of lithology is different from interpretation of units on the basis of sherds found within levels, the subtle distinction did not carry over to future generations of American archaeologists. Stratigraphy became the extraction of artifacts in ways meaningful to telling time, as well as (though less emphasized) the description of the layering observed in the site. Phillips et al. (1951) focused on artifacts; deposits were essentially ignored. In North American archaeology, for all practitioners except those studying Paleoindians, stratigraphy became associated with artifacts and dating through seriation. Because artifacts were the data of significance, geological stratigraphy was regarded as irrelevant or at least less important.

Harris Matrices

Following the "stratigraphic revolution" and the development of particularistic North American archeological stratigraphic terminology, the next invention to influence stratigraphic dating in North America was the Harris Matrix. American archaeologists were influenced greatly by Edward Harris, the historic archaeologist who first introduced a sophisticated and systematic method for correlating and recording strata in urban settings. Harris (1975, 1977, 1979, 1989) developed the method as part of the Winchester Research Unit in England when he became frustrated by two-dimensional representations of complex superpositional relationships evident in walls, floors, and urban remodeling. The Harris Matrix is a two-dimensional representation of three-dimensional strata encountered during excavation. It allows the recorder to keep track of the relationship between each layer and all the rest of the layers in the site, not simply the strata that appear in one particular profile. Each layer is represented by a rectangle of uniform size. The placement of the rectangles relative to each other corresponds to the temporal (superpositional) ordering of their deposition. The matrix is, therefore, a record of the temporal superposition of all strata in the site.

Edward Harris was influenced by Martin Biddle, the director of the Winchester Research Unit, who in turn was trained by Mortimer Wheeler. In 1950, the standard method of excavation in historical archaeology was the "Wheeler Box Method," using baulks and 10-foot squares (Wheeler 1954). Stratigraphy was preserved in the baulks, so the sequence of architectural construction and collapse could be reconstructed through the systematic inspection of side walls. This method was brought to North American historical archaeology by Ivor

Noel Hume, who, as Director of Archaeology at Colonial Williamsburg, used it to excavate sites with complex stratification in Virginia's eighteenth-century capital from the late 1950s to about 1980 (Brown and Muraca 1993).

The interesting historical fact is that Noel Hume disliked the Wheeler Box Method and argued that one should keep track of all layers and their relationship to each other across the whole site (Noel Hume 1969) but never followed his own advice. At Williamsburg, he excavated each square separately and never recorded any correlations between them. Perhaps the reason for this was that Noel Hume was never motivated to make the attempt, for he had documentary evidence that recorded historical events associated with the site (Noel Hume 1970) and chronology based on the archaeological layers therefore may have seemed irrelevant.

Although growing out of the Wheeler tradition, Harris's suggestions of single-context planning and tabulating of all strata (not just those that intersected the side wall) represented a reaction against the Wheeler technique, and the Noel Hume practice. Wheeler's technique encouraged its users to excavate each "box" or square separately, producing as many stratigraphic sequences as there were excavation units, and therefore permitting excavators to ignore the issue of how they might be related. Harris's methods were designed to facilitate recovery of a single sequence that integrated all the strata occurring in the entire excavation area.

The suggestion of recording every layer as it was excavated was new to historical archaeologists. Previously, they had texts, coins, inscriptions, and documents from which to derive general dates of building and occupation. Harris advocated the use of the matrix for deciphering small-scale temporal events that occurred within the urban setting, such as road building or house remodeling. Instead of looking only at sections (as Schliemann, Wheeler, and Noel Hume did), historical archaeologists were now expected to number and describe each wall, trench, and floor, and place them on a Harris Matrix. Layers could no longer be excavated without carefully recording their exact relationships and could not be considered only as recollections of the excavator. One had to pay attention to details during excavation and to make superpositional assignments as the digging progressed.

In 1983, some urban archaeologists in Europe revised their excavation strategy so much that they found it necessary to publish a Guide to Archaeostratigraphic Classification and Terminology. The guide

was followed by a roundtable discussion at the University of Ghent in 1983, the "Workshop for Archaeostratigraphic Classification and Terminology" (ACT workshop). From this group, the periodical *Stratigraphica Archaeologica* presented contributions on classification and terminology, as well as explanations of types of stratigraphic units. The guide and journal generated much comment (Cremeens and Hart 1995; Farrand 1984a, 1984b; Stein 1987, 1990, 1992, 1996) that focused on whether archaeological stratigraphy is different from geological stratigraphy.

Although Harris contrasts his view of stratigraphy with those of the group meeting at Ghent (Brown and Harris 1993), archaeologists who excavate historic urban sites developed a new interest in stratigraphy and stratigraphic dating, stronger by far than that called for by Wheeler and Kenyon and boldly newer than anything suggested by Noel Hume in America. The orientation of these urban archaeologists comes directly from their intellectual history. They were trained in the classics and in history, not the geosciences and anthropology. When they turned toward stratigraphy in 1975, they believed emphatically that the strata in their sites did not relate to geological or seriation-based stratigraphy:

> We do not wish to denigrate in any way the results which geoarchaeologists and other specialists may make to archaeological projects in geological settings. It is simply that... we do not think that these geological methods can be extended to a majority of archaeological sites, which are those stratigraphically fabricated as a by-product of human society. Nor do we think that the theory underlying those methods can be suitably applied to the discipline of archaeological stratigraphy. (Brown and Harris 1993:15)

They believe that the superposition noted by constructing Harris Matrices is different from the superposition that geoscientists use.

Harris is emphatic that the important unit in his archaeostratigraphy is the boundary around the layer, called an interface. It holds the key to the appropriate placement of a rectangle on the page. Harris is correct. No stratigrapher from any discipline would disagree. What Harris does not appreciate is that the act of noting elapsed time in boundaries of layers is not the art of defining a physical stratigraphic unit. Describing the physical unit during excavation and interpreting elapsed time is thus a two-step task; interpretation follows description.

With regard to the first, descriptions of strata were not systematically

recorded by archaeologists until quite recently. Field notes may have included the color of an unusual stratum or the shape of a feature, but most excavators did not (and do not today) record the physical attributes of every layer in their sites. They recorded the kinds and densities of artifacts but not the physical descriptions of the strata.

With regard to the second, assigning an age to a stratum requires that an archaeologist determine the age of manufacture of an object in that stratum or the age of an object nearby. This age determination is therefore an interpretation based on association, correlation with other sites, or dates derived by some absolute dating technique. The age of the stratum is therefore inferred from the age of manufacture of an object found within it or from the association of that object with some datable substance. Determining the age of all strata near the object involves an assessment of the relative superpositional relationship of the layers and the object, as well as an assessment of the rate of accumulation. Archaeologists often presume that if one stratum contains an object made during a period from, for example, 1,000 to 800 years ago, the strata above must be younger than 800 years old, and the strata below must be older than 1,000 years. These determinations are based on an inferred rate of accumulation (Ferring 1986). Thus, units of time are interpretations, based on ages of objects, superposition, and rates of accumulation. The interpretation follows description in a two-step procedure.

Perhaps the point is moot that deposit descriptions are different from interpretations of time. In the end Harris constructs a matrix that is correctly drawn and dated relatively using superposition. He does not choose to recognize the task as that involving different steps and therefore believes that the one step (drawing a Harris Matrix based on interfaces) is the end of stratigraphy. The matrix is, either way, important for stratigraphic dating. It improved our ability to record superposition and therefore engage in stratigraphic dating. Archaeostratigraphers with a more geological bent would say that this is just the beginning, however. They would take the matrix and draw boundaries on it in the locations where various kinds of data change in frequency or appear or disappear (see Stein [1992, 1996] for examples of this approach).

When someone new to stratigraphy examines the methods of archaeological stratigraphy proposed in 1975, and followed by Harris and other urban archaeologists, they may not understand why Harris contrasts his stratigraphy so strongly with that of geoscientific stratigraphy. Harris is emphatic that stratigraphy in archaeological sites is

different from stratigraphy in either prehistoric sites, where geological forces overwhelm cultural forces, or geological sequences. He calls walls upstanding strata (Harris 1989:48) and denounces any attempt to borrow terminology from geostratigraphic codes or guides. Because Harris emphasizes differences, he implies that geoscientific stratigraphic dating is different from archaeological stratigraphic dating. I think the explanation for this emphasis lies in the history of how historical archaeologists came to use stratigraphy. Historical archaeologists use superposition to arrange site strata in a relative sequence. Although they note superposition, they do not really need it to date their layers within the sites. Only when they wish to date small-scale events that were unaccompanied by textual dates, did they need to excavate walls and floors separately and record their relative superposition. They came independently to call this method stratigraphy and believed it to be different from stratigraphic practice elsewhere.

Some people disagree with Harris (Colcutt 1987; Farrand 1984a, 1984b; Stein 1987, 1990, 1992) and suggest that stratigraphy in historical sites as well as North American prehistoric sites dated by seriation is still stratigraphy and that stratigraphic dating is the same whether used in geosciences or in North American prehistoric, Paleoindian, or historical archaeology. These scholars applaud the invention of the Harris Matrix as a recording and interpretive device because in its fundamental simplicity it demonstrates that superposition works everywhere, just as Steno suggested. Perhaps the best indication of the rapid acceptance of the Harris Matrix is its use by archaeologists who are oriented to prehistory (e.g., Parkington, personal communication 1998, is using them at Elands Bay Cave in South Africa), middens (Stein 1996; Stein et al. 1992; Stucki 1993), Mayan cities (Hammond 1993), and historic sites (see examples in Harris et al. 1993). The matrix is a recording device that is incredibly useful for complicated stratigraphic deposits. No matter what one does with the resulting matrix, the appearance of the Harris Matrix represents an important moment in the history of stratigraphic dating.

Geoarchaeology and Site Formation Processes

At roughly the same time Harris Matrices were introduced to North American archaeology, the fledgling discipline of geoarchaeology began to influence North American archaeologists trained in seriation and who used the terminology of Willey and Phillips (Butzer 1964, 1971; Davidson and Shackley 1976; Gladfelter 1981; Willey

and Phillips 1958). Geoarchaeology thus grew alongside a newly forming emphasis on site formation processes and middle range theory (Binford 1964, 1977; Schiffer 1972, 1976) that considered the "natural processes" impacting artifacts and cultural strata. Karl Butzer (1964) and C. Vance Haynes (1964) were perhaps the first and most influential geoscientists to convince North American prehistoric archaeologists that an environmental approach was critical to proper interpretation of the archaeological record. Geoarchaeology was gaining recognition from the prehistoric archaeologist who had not traditionally used geoscientific methods or geoscientific stratigraphy.

Geoarchaeology, and the consideration of stratigraphy as something more than just superposition, actually appears in North American archaeology at two different times, each of which is thought by some to be the original geoarchaeology. The first was the collaboration revolving around Paleoindians that began at the turn of the century with Hrdlička's recommendations and Kirk Bryan's insistence (Mandel 1999). The second was the awakening in the 1970s of prehistoric archaeologists who were trained in the tradition of seriation and who suddenly realized that collaboration with geoscientists was potentially beneficial (Gladfelter 1981). Obviously the beginning of the collaboration defined as geoarchaeology occurred at both times, but the actual term "geoarchaeology" did not appear until the second (Renfrew 1976).

The interest in geoarchaeology and the impact of it on archaeology grew in the 1970s when it was associated with the New Archaeology. The magnitude of this impact is witnessed to by the number of geoscientists who vociferously joined these early discussions and urged prehistoric archaeologists, who were not already using geosciences in the search for Paleoindian sites, to consider all kinds of geoscientific methods and approaches in their excavations and research (Gladfelter 1977; Hassan 1978, 1979; Herz and Garrison 1997; Rapp 1975; see also Rapp and Hill 1998; Waters 1992).

Only in the 1970s did geoarchaeologists begin to contribute to stratigraphic dating in a variety of North American archaeological research, not just those associated with the most ancient remains. The contributions focused on natural and cultural processes that disturb contexts and on reconstructing paleoenvironmental contexts (Schiffer 1972). This collaboration came late and did not strongly influence the use of stratigraphic dating or stratigraphic methods in general. The methods and terminology in the North American archaeological discipline had been set and geoarchaeology and new kinds of stratigraphy had to fit within those methods or they would be ignored.

This chain of events is recorded indelibly in archaeological terminology still being taught and used today. Many terms connote an early focus on artifact seriation and a lack of concern for other objects that could not be seriated. For example, the word "matrix" in archaeological parlance refers to "the physical material that surrounds, holds, and supports an artifact" (Sharer and Ashmore 1993:616). Thus, "matrix" is the material that an excavator tries to separate from the artifacts, the material going through the screens. It is observed, some descriptive information, such as color, is recorded, then it is discarded. The term matrix was defined within archaeology when the artifactual perspective dominated the discipline, and remains in this use today. Most archaeologists now realize that the "matrix" can nevertheless reveal abundant information if appropriately analyzed using geoarchaeological methods. Yet many archaeologists still call the material matrix and refuse, perhaps subconsciously, to use the more precise terminology of sediment, soil, and deposit (Stein 1987).

Another example of this artifact-oriented archaeological terminology, one that relates directly to stratigraphic dating, is provided by comparison with geoscientific (stratigraphic) nomenclature. In archaeology, a "component" is an important term for stratigraphic dating, defined as "a manifestation of any given focus at a specific site, a focus being that class of culture exhibiting characteristic peculiarities in the finest analysis of cultural detail" (McKern 1939:308). A simpler definition is that offered by Brian Fagan (1988:575): "a component is an association of all the artifacts from one occupation level at a site." A component is a fundamental unit used for the purpose of correlation (stratigraphic dating) from one site to another. In geoscientific stratigraphy a fundamental exercise is the correlation of units across space. Any class of data that will enlighten the correlation may be selected, be it foraminifera, plants, tephra, or magnetic signals. Using artifacts for such correlations is an analogous procedure. The act of defining components is consistent. The term "artifact" could therefore be inserted into any of the geoscientific codes (Stein 1987, 1990).

"Phase" is another fundamental term used in archaeological stratigraphic dating, defined as "an archaeological unit possessing traits sufficiently characteristic to distinguish it from all other units similarly conceived, whether of the same or other cultures or civilizations, spatially limited to the order of magnitude of a locality or

region and chronologically limited to a relatively brief interval of time" (Willey and Phillips 1958:22). Fagan's (1988:504) definition is shorter: "a phase [consists of] similar components from more than one site." Note that to define a phase, one has to collect information about culturally significant artifacts, time, and space. Once the relevant attributes are described, a phase is supposed to be used to correlate the same "people" moving in the same "time," "across different places on the landscape."

The guidelines set forth in geoscientific stratigraphic codes would exclude the phase as an acceptable stratigraphic unit, and many archaeologists agree that phases are indeed problematic entities, as defined (Willey 1985). Archaeologists are aware that the stratigraphic unit "phase" has within its definition a mixture of attributes requiring numerous observations or multiple classification systems that are difficult to define and collate (Rouse 1955). In many regions, the archaeologist familiar with the sites, artifacts, places, and times knows that phases are not easily correlated. The diagnostic cultural traits change in frequency or in manufacturing styles. Phase timing is often demonstrably transgressive across landscapes. The associated fauna, agricultural plants, architectural style, or preferred landforms often do not remain the same from the type site to other sites in the region. The use of phase as a fundamental unit in stratigraphic dating is inherited from the period before geoarchaeologists collaborated in meaningful ways with North American archaeologists.

In geoscientific guides, units are based on physical properties observed in the field (lithostratigraphic units called "formations"), on fossil content (biostratigraphic units called "biozones"), magnetic properties (magnetostratigraphic units called "polarity zones"), or time (chronostratigraphic units called "chronozones"). When following archaeological procedures, however, one relies on different datasets (e.g., lithics, bones, plant remains, ^{14}C dates) to define units usually grouped into one kind of stratigraphic unit that then becomes the type profile for the stratigraphy of a whole site. The stratigraphic units of an archaeological site are described under the section of the site report called "site stratigraphy" as one sequence of units (for example) numbers 1 through 7, or A through M. The stratigraphy of the site is not discussed repeatedly as each type of artifact is presented. Rather, each type of artifact is crammed into one stratigraphic sequence. North American archaeologists who collaborate with geoarchaeologists are beginning to understand this distinction. They are eliminating the use

of phase in exchange for the newer, more powerful, stratigraphic correlation techniques and terminology.

What therefore appears to be happening in the last decade is a "closing of the gap" between archaeologists who study Paleoindian sites and those who study hunter-gatherers, early agriculturalists, village dwellers, or historic peoples. An emphasis on geoarchaeology and site formation processes, along with the use of Harris Matrices, demands that everyone pay close attention to context and superposition, which in turn propels North American archaeologists closer to geoscientific stratigraphy and more elaborate concepts of stratigraphic dating.

Conclusion

The history of stratigraphic dating in North American archaeology is a long and circuitous narrative involving events in both Europe and North America. Various kinds of archaeologists contributed to this narrative, including European prehistorians and classicists, North American archaeologists searching for the earliest Americans (Paleoindian occupation), prehistorians using seriation of pottery and projectile points, as well as historical archaeologists.

Of greatest interest in this review of stratigraphic dating are the pieces contributed by the North American archaeologists. The earliest of these contributions was made by those investigating the antiquity of people in the Americas. These archaeologists remained close to their geoscientist colleagues, especially Quaternary geoscientists. Beginning at about the turn of the century, they used stratigraphic associations of Ice Age fauna and artifacts to establish antiquity of people in the Americas.

Closely following the earliest effort was the contribution of archaeologists investigating more recent sites, especially sites with pottery. These scholars depended on seriation to date their artifacts and relied on superposition to guide the seriation process. Stratigraphy was intertwined with the methods of artifact seriation to build chronologies for the whole of North America.

Historical archaeology then contributed the Harris Matrix to the improvement of stratigraphic dating and archaeological stratigraphy. This recording device required archaeologists to describe three-dimensional strata in the field, including the superpositional relationship of each across the whole site. Sophisticated sequences of superposition could be constructed using the Harris Matrix, a fact recognized in its adoption by practitioners of Paleolithic, Paleoindian, Mayan, and other archaeologies.

The last major contribution was provided by geoarchaeologists in conjunction with the New Archaeology. As more sites were excavated and detailed research questions asked, the chronologies originally constructed began to show cracks (Willey 1985). Not only were chronologies being criticized but the interpretations made from artifact patterns were also being questioned. New Archaeologists pointed to the importance of site formation processes and their ability to destroy patterns set by behavior. They even pointed to examples where the superpositional relationship of artifacts laid down by cultural processes had been reversed by natural processes. Culture historians who once focused on building chronologies have now turned toward an expanded conception of stratigraphy, derived from geoarchaeology, to assist in the reconstruction of deposition and postdepositional alterations.

The different contributions offered by each group are important to understand because archaeologists have had problems in standardizing the stratigraphic nomenclature of the discipline. Attempts on both sides of the Atlantic were made in the 1980s to standardize stratigraphic terminology (Farrand 1984a, 1984b; Gasche and Tunca 1983; Shaw 1970; Stein 1987; 1990), but these attempts have been hampered by the fact that participants do not appreciate that European urban archaeologists, prehistorians, and Americanists all bring different biases to any discussion about stratigraphy and stratigraphic dating. Archaeologists agree that problems exist, but they envision that they have all experienced a different history of stratigraphic dating and believe there are different problems to solve. Nevertheless, the history of stratigraphic dating reveals clearly that the problems are similar, and archaeologists are closer than ever before to achieving some agreement on nomenclature.

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CHAPTER 3

The Foundations, Practice, and Limitations of Ceramic Dating in the American Southwest

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The identification, description, and interpretation of cultural variation is the focus of archaeological research. Whether variation is viewed synchronically in descriptions and comparisons of different cultural forms, or diachronically as the study of culture change, control of time is an essential element of the discipline. Toward that end, a tremendous amount of effort, money, and intellectual energy has been invested in the development and use of chronological tools and concepts. Ceramic dating is one of these, and in ceramic dating, we have a glorious circularity. We take advantage of an aspect of culture change to provide a temporal framework for the study of culture change. This framework works elegantly and efficiently in the vast majority of cases, but the inherent circularity is never left far behind.

In this discussion, I draw on the culture area I know best, the Southwestern United States. Pottery has been emphasized in the practice of Southwestern archaeology for more than a century, and nearly all developments in ceramic dating have been applied in this context. The relative sufficiency of the Southwest as an example of the development and practice of ceramic dating is also due in part to the luxury of an extensive archaeological record in an arid landscape. The physical structure of sites and their material culture content are preserved with a nearly unparalleled visibility, and the archaeological record is rich but not so rich as to be dominated by confusing overlays of components. On this landscape, 2,000 years of Southwestern culture history have been played out with pottery as both a major part of the artifact inventory and a major tool for archaeological interpretation.